WAVES

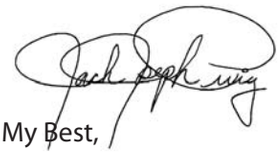
PUIGCHILD

COMPRESSOR / LIMITER

WAVES

Los Angeles, CA
November 2011

It's just fantastic that one of my favorite pieces of gear has been resurrected in a 21st century incarnation: the classic Fairchild 670!
The PuigChild compressor truly captures the vibe of the original, and as a piece of hardware, it allows us to have the same tactile experience with the same unique sound. The new unit also has excellent high definition input and output converters that deliver the maximum representation of the remarkable modeling of the 670. It's like a dream come true. I hope you all enjoy it as much as I do; it's quickly become one of my go-to compressors.



My Best,
Jack Joseph Puig

Table of Contents

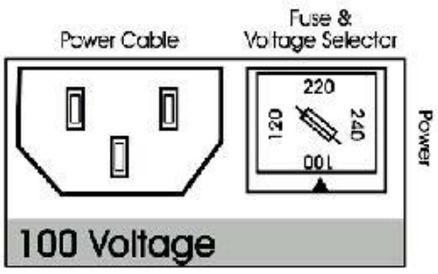
IMPORTANT SAFETY CONSIDERATIONS	5
Package Contents	6
Introduction	7
Internal Processing	8
Controls Overview	9
Connecting the PuigChild	11
Input/Output Calibration Controls	13
Rear Panel Sync & Word Clock Connections	13
Front Panel Controls – In Depth	14
Connection Examples	17
Technical Specifications	18
Troubleshooting & Frequently Asked Questions	19
Contact Waves Sales and Technical Support	20
One Year Limited Warranty	20

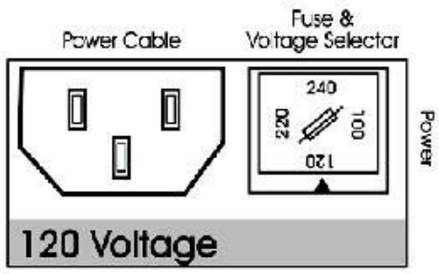
IMPORTANT SAFETY CONSIDERATIONS

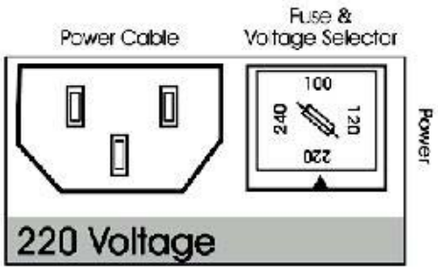
Securely mount the Waves PuigChild in a 19" studio rack away from rain, moisture, liquids, heat sources or fire using the four supplied mounting bolts. (Plastic washers are provided to prevent scratching). Apply the rubber feet for desktop use.
In case of damage to the Waves PuigChild due to spilled liquids or physical damage from knocks or dropping, repairs should be performed by qualified service personnel only.
Read all operating instructions.
Do not allow children to use the PuigChild without adult supervision.
Do not overload audio inputs or outputs. Waves will not be responsible for damage caused to other equipment (such as speakers) through misuse.
Do not block the ventilation grills that are located on the sides of the unit.

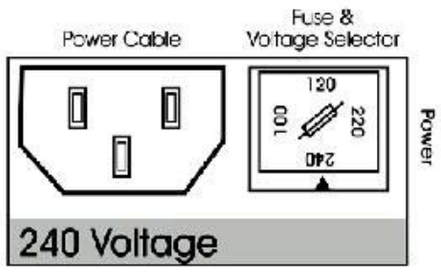
PLEASE NOTE: THE POWER SUPPLY IS NOT AUTO-SWITCHING!

You must check to make sure the voltage rating shown directly on the back panel of your Waves PuigChild is appropriate for your power connection. Please see the diagram below. To change voltage, gently pull out the fuse holder. It can be pried out by inserting a screwdriver under the edge by the IEC plug and pulling out gently. Insert it back with the desired voltage positioned according to the 4 diagrams below. Make sure that the desired voltage marking is at the top of the compartment.









Please read, complete and return by mail the Warranty Registration Form entitling you to technical support and service under warranty.

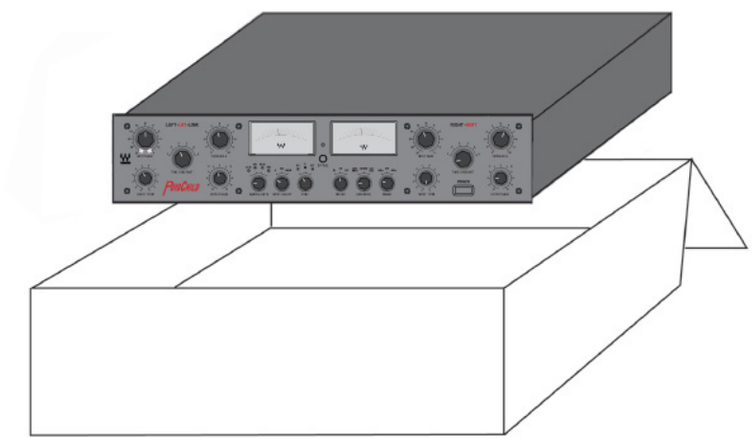
WARNING: CLASS 1 LASER PRODUCT (SINGLE-MODE)

Package Contents

- 1x Waves PuigChild compressor
- 110 v USA power cable
- 220 v European power cable
- Three (3) sets of four (4) mounting bolts each
- Spare fuse
- Four (4) rubber "feet"
- Four (4) plastic washers
- User manual

Unpacking the Waves PuigChild

After unpacking the PuigChild unit, please check it carefully for any damage. If any damage is found, immediately notify the carrier that brought you the package. You, the consignee, must initiate any claim. Please retain all packaging in case of future re-shipment.



Mounting the PuigChild

Before connecting the PuigChild, be sure to securely mount it in a standard 19" studio rack-mount away from heat and moisture. We recommend using the supplied plastic washers between the PuigChild and the mounting bolts to protect the PuigChild's front panel from scratches. Alternatively, for desktop use, attach the four rubber feet to the bottom of the PuigChild.

Introduction

Thank you for choosing the Waves PuigChild. Be sure to read the safety considerations before you plug in and switch on the PuigChild's power. Please spend some time reading through this manual so that you obtain the best possible performance from the unit. For more information about our products, please visit www.waves.com.

Features

- Full 48-bit internal processing
- Supports sampling rates up to 96kHz
- A wide variety of analog and digital connectors for compatibility with all popular formats
- 16/24-bit digital I/O
- Outstanding AD/DA conversion using 24-bit converters and transformer-based analog input/output stages

About the PuigChild

Among gear aficionados, the stereo Fairchild 670 is considered the most coveted of all compressors, not only because of its pristine sound, but also its rarity and price: 670s routinely go for tens of thousands of dollars on the vintage market. (They originally cost less than $1000). With 20 vacuum tubes and 11 hand-wired transformers in a hefty 6 rack-space chassis, these hard-to-find units weigh in at a robust 65 lbs.
Designed by Estonian-born Rein Narma in the early 1950s, both the stereo 670 and its mono counterpart the Fairchild 660 use single push-pull amplification stages with extremely high control voltages. Both variable-mu limiters are unique in that they use tubes for gain reduction as well as amplification. Compression takes place directly in the audio path, rather than being routed to a separate circuit.
Prior to the 660 and 670, Narma's Gotham Audio Developments had built consoles and components for such luminaries as Rudy Van Gelder and Les Paul. Shortly after Paul asked Narma to build a limiter, Sherman Fairchild caught wind of the project, licensed the design, and hired Narma to come onboard as the company's chief engineer. After his stint at Fairchild, Narma relocated to the San Francisco Bay Area and became vice president of Ampex, pioneers of multitrack recording equipment.

About the Modeling

Many different elements contribute to the unique sonic characteristics of analog gear such as the Fairchild 670. Waves painstakingly modeled and incorporated these elements into the PuigChild in order to fully capture and replicate the sound and performance of the original equipment.

These are some of the most important elements of analog behavior:

- **Total Harmonic Distortion**

  Perhaps the most important analog behavior is Total Harmonic Distortion or THD, which is defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency. THD is usually caused by amplification, and changes signal shape and content by adding odd and even harmonics of the fundamental frequencies, which can change the overall tonal balance. THD can also change peak output gain, usually by no more than +/- 0.2-0.3 dB.

- **Transformers**

  Some hardware uses transformers to stabilize or change Input/Output loads and signal levels. In earlier days, transformers did not have a flat frequency response, and often introduced low and super-high frequency roll offs. The original Fairchild has four transformers, so if you encounter a low or extremely high frequency loss, this is due to the modeled transformers.

- **Long Release Times**

  The Fairchild includes settings which use long time constants of several seconds. This might cause short looped passages to sound different during successive playbacks, because the Release never returns to unity. This is identical to the original hardware performance, and should not be a cause for concern.

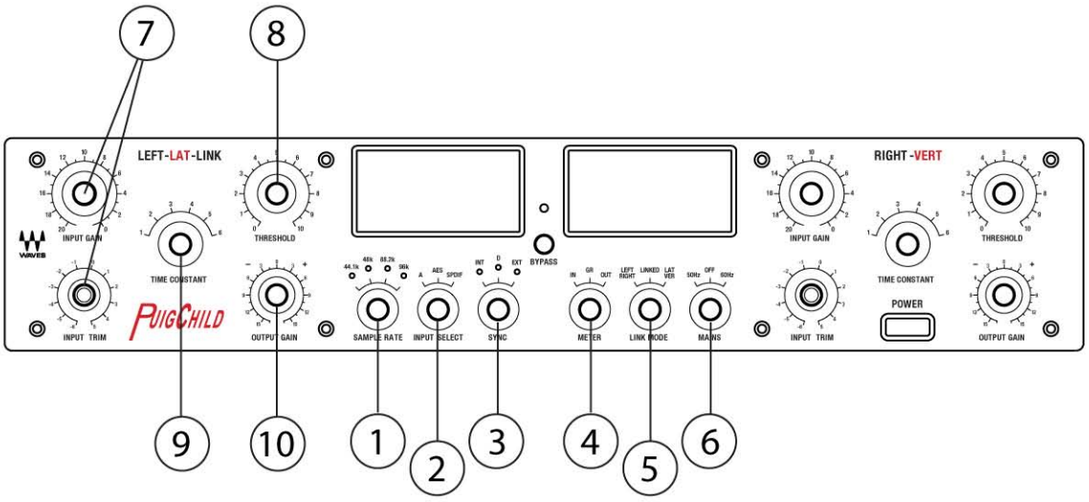
- **Hum**

  Waves modeled both 50Hz power current and 60Hz power current. If you listen closely, you will hear that there is a difference in hum level between 50Hz and 60Hz. Since hum is unique to each region and dependent upon the local electrical conditions, you may find that the modeled hum is different than the hum already present in your studio, and may not be suitable for your particular use.

Internal Processing

The PuigChild performs all digital processes with 48-bit internal precision (double precision). The internal processing is followed by re-quantization (wordlength reduction) from the internal 48-bit data to 16 or 24-bit output wordlengths. (Analog output always used the full 24-bit wordlength). The system can also be used to re-quantize 24-bit input signals to 16-bit (via the digital outputs only).

Controls Overview

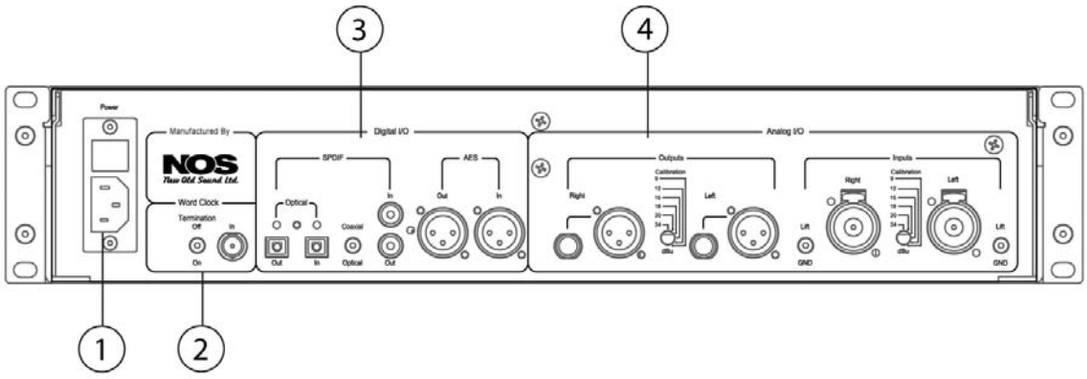


Global Controls

1. **Sample Rate** controls operating sample rate.
2. **Input Select** controls input type.
3. **Sync** chooses sync source.
4. **Meter** chooses which audio signal will be displayed: input, gain reduction or output.
5. **Link Mode** controls the relationship between the left channel and the right channel.
6. **Mains** controls analog characteristics caused by noise floor and hum, based on the power supplies of the original units.

Compressor Controls

7. Input controls (analog input gain & digital input trim) the volume of the signal entering the audio compression path.
8. Threshold sets the amount of signal compression.
9. Time Constant controls the fixed Attack and Release lengths.
10. Output controls the output level.



Rear Panel

1. **Main Power Supply** connects the PuigChild to the power supply.
2. **Word Clock** provides digital synchronization interface.
3. **Digital I/O Interface** allows digital I/O connection of various types.
4. **Analog I/O Interface** allows analog I/O connection of various types.

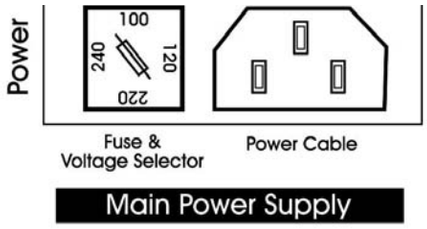
Connecting the PuigChild

Main Power Supply: 100, 120, 220 or 240 volt selectable

PLEASE NOTE: THE POWER SUPPLY IS NOT AUTO-SWITCHING!

You must make sure the voltage rating shown on the back panel of your PuigChild is appropriate for your power connection.

The power cable socket and fuse-holder with voltage selector are located together on the back panel of the PuigChild. Plug the supplied cable into the back of the PuigChild and into your power connection. Switch on the PuigChild using the on/off power switch located on the front panel. When you switch the power on, the front panel LED displays will illuminate.



Replacing the Fuse

If the fuse blows, switch off the power and unplug the unit. Pull off the fuse holder (see diagram above) and replace the fuse. Do not forget to replace it with the proper voltage selection indicated!

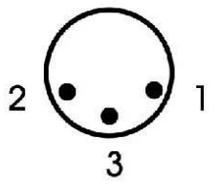
We suggest using the following UL listed (slow-blow) fuses:

- For 100/120 V, use a 200 mA fuse
- For 220/240 V, use a 100 mA fuse

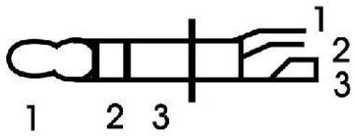
Rear Panel Analog Connections

The PuigChild accepts the following connectors:

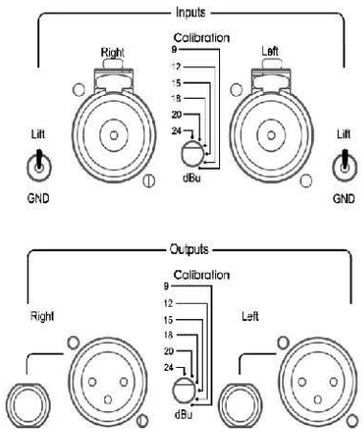
- XLR/TRS combo inputs connector type for balanced / unbalanced in-puts.
- XLR connector type for balanced outputs.
- TRS (1/4") jack connector type for balanced or unbalanced outputs.



*Viewed from the solder side
1: Ground
2: +/Hot
3: -/Cold



1: Tip/High
2: Ring/Low
3: Sleeve/Ground

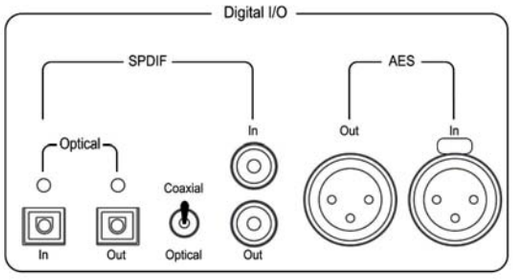


Left & Right Input/Output Connectors

Rear Panel Digital Connections

The PuigChild accepts the following digital inputs and outputs:

- XLR type input/output connectors for AES/EBU signals.
- RCA type input/output connectors for S/PDIF signals.
- Optical type input/output connectors for S/PDIF signals.



S/PDIF input/output uses either RCA or Optical connectors. The input format is selected using the Coaxial/Optical selector switch.

Please note: When working in analog mode (A) and selecting sync to Digital (D), the PuigChild sync to AES input only.

Input/Output Calibration Controls

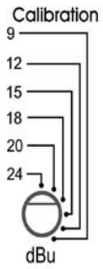
The calibration controls are used to adjust the signal output that runs from your analog device to the PuigChild's input, and the analog output of the PuigChild to the next unit in the signal chain, allowing you the maximum available headroom.

Input Calibration

Set your analog device to its maximum output level and set the input rotary switches on the PuigChild front panel to unity gain. Then, adjust the input calibration so that your peak signals are between -6 and 0 dBFS on the input meters.

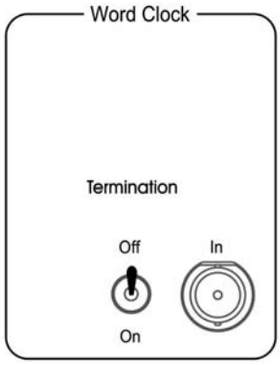
Output Calibration

To adjust the PuigChild's output, set the calibration control so that the input level on your analog device that follows the PuigChild in the signal chain does not exceed unity gain.



Calibration Options
Input: + 9, 12, 15, 18, 20, 24 dBu
Output: + 9, 12, 15, 18, 20, 24 dBu

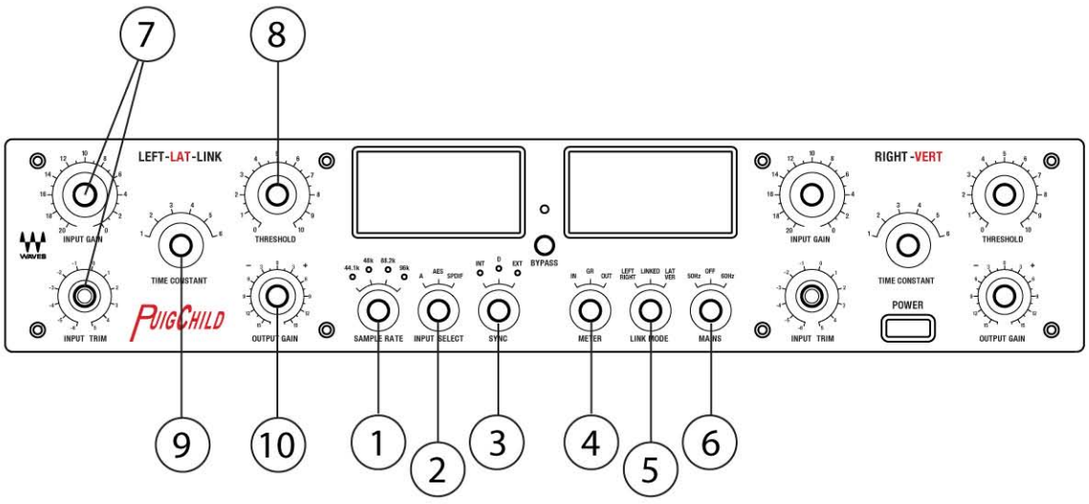
Rear Panel Sync & Word Clock Connections



The PuigChild can be connected to an external word clock source (using a BNC connection) or you can use its internal clock. An external word clock is utilized for applications that require synchronization with other digital audio devices. The internal clock setting is selected on the front panel only when using the PuigChild's analog inputs.

The Termination on/off switch enables the PuigChild to perform wordlength impedance-matching when multiple word clock sources are chained together. Correct termination of word clock inputs is crucial for a stable clock configuration. As the frequency of a word clock signal increases, termination requirements become more critical for precise transmission. In order to ensure the integrity of the clock waveform, each connection should be terminated by a 75 ohm load impedance. Over-termination (load impedance lower than 75 ohms) will attenuate the signal excessively, while under-termination (load impedance greater than 75 ohms) introduces overshoot and other waveform distortions. Both conditions compromise clock accuracy.

Front Panel Controls – In Depth



1. **Sample Rate** selects / displays the PuigChild sampling rate. PuigChild supports operating sample rates up to 96 kHz. You can only change the signal sample rate when the PuigChild's Sync mode is set to Internal. At the other settings the PuigChild locks to the digital stream or external Word Clock source. The PuigChild will automatically detect and display the sample rate for all other Sync modes.

   Options: 44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz

2. **Input Select** selects / displays currently active PuigChild input. Note that the audio is always sent to all outputs concurrently, regardless of the selected input source.

   Options: A=Analog, SPDIF=S/PDIF (RCA / Optical)*, AES = AES (XLR)

3. **Sync** selects / displays the synchronization source for PuigChild. Rotate the Sync knob to select sync source. The Internal (INT) setting uses PuigChild's internal clock. Digital (D) synchronizes with the digital input signal (AES/EBU or SPDIF). Word Clock (WC) syncs to an external word clock source connected to PuigChild's Wordclock BNC input located on the rear panel. If sync signal is lost, the Sync LED will flash.

   Options: INT = Internal, D = Digital S/PDIF (RCA) or AES (XLR), WC = External word clock synchronization.

4. **Meter** chooses which audio signal will be displayed on the VU meters.

   Options: IN = Input, GR = Gain Reduction, OUT = output

5. **Link** controls the relationship between the left (upper) channel and the right (lower) channel.

   States
   Left/Right, Linked, Lateral/Vertical

   Left/Right
   The compressor acts as two completely separate compressors, with the option to separately adjust all controls per channel. This mode can significantly change the stereo image of a stereo signal.

   Link
   Both channels are linked to one another. Upper channel controls both channels, while lower channel settings are grayed out. The compression detector will calculate the maximum level of the two channels combined, and compress both channels according to the maximum level. This mode better preserves the stereo image of a signal.

   Lateral/Vertical
   Feeds the stereo signal through a sum/difference matrix which splits the stereo signal into sum (fed to the upper/left channel) and difference (fed to the lower/right channel). The input level is set after the matrix, so the relationship between the sum and the difference channels can be controlled. At the compressor output, the signal passes through a second matrix which turns it back into a Left/Right stereo signal. (Output gain occurs before the second matrix).

6. **Mains** control analog characteristics caused by noise floor and hum, based on the power supplies of the original units.
   Range: Off, 50Hz, 60Hz

7. **Input Gain/Trim** controls the volume of the signal entering the audio compression path.

   Input Trim
   Controls the level of the analog input
   Range: -6 to +5 dB
   Resolution: 1 dB steps

   Input Gain
   Controls the volume of the signal entering the digital audio compression path.
   Range: -20 to 0 dB
   Resolution: 1dB steps
   Note: -14dB is unity gain (input = output)

8. **Threshold** sets the amount of signal compression.
   Range: 0 to10

   Resolution: 0.1 steps

Please note: The scale is not linear, and has been adjusted to conform to the exact scaling of the modeled unit. Thus, there may be more compression than expected at certain steps, as with analog gear.

9. **Time Constants** controls the fixed Attack and Release lengths. The position values are based on the original values, as publicized by Fairchild. Our measurements, however, differed considerably from the values given. Therefore, we suggest using these values as a rough guide, based on 10 dB of compression.

   Range: 1 to 6
   Resolution: 1, 2, 3, 4, 5, 6

   Position 1
   Attack: .2 ms
   Release: 0.3 seconds

   Position 2
   Attack: .2 ms
   Release: 0.8 seconds

   Position 3
   Attack: .4 ms
   Release: 2 seconds

   Position 4
   Attack: .4 ms
   Release: 5 seconds

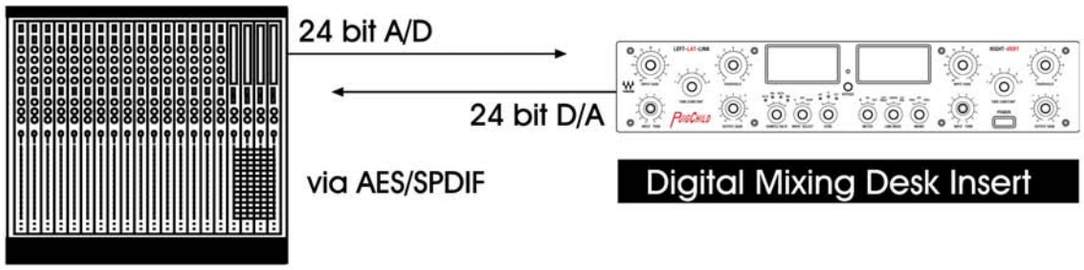
   Position 5
   Attack: .4 ms
   Release: Automatic based on program material — 2 seconds for individual peaks, 10 seconds for multiple peaks

   Position 6
   Attack: .2 ms
   Release: Automatic based on program material — 0.8 seconds for individual peaks, 10 seconds for multiple peaks, 25 seconds for consistent high program level.

10. **Output** controls the output level.
    Range: -18 dB to +18 dB (in 0.1 dB steps)

Connection Examples

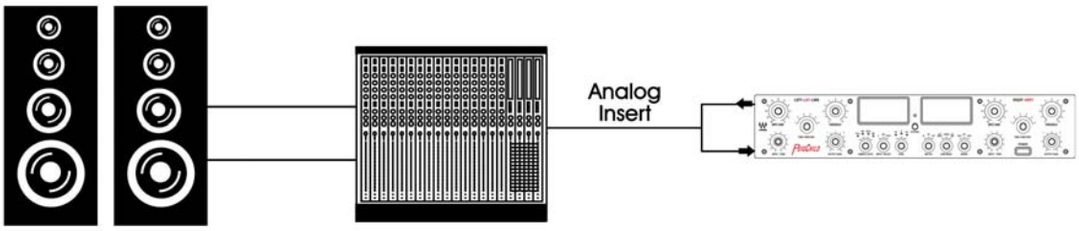
Digital Mixing Desk Insert/FX (Individual Channels, Bus/Group)



Connect a send point or an insert point from the mixing desk to the appropriate digital input of the PuigChild. Connect the PuigChild's digital output to the Send/Insert return point.

If your console has word clock, it can be used, although it is easier to simply select D (Digital) on the PuigChild's front panel Sync selector. If you are using a master word clock to sync several devices, you can use the word clock sync input on the PuigChild, and select the WC (word clock) sync source. In either scenario, your mixer will be the master clock.

PuigChild as Analog Insert (Individual Channels, Bus/Group)



PuigChild and MaxxBCL on Master Outs for Live and Recording

Technical Specifications

Maximum Analog Input Gain: 24 dBu

Input Impedance, Balanced Input:
32 kOhm @ 1kHz

ADC (@ 44.1 kHz)

Frequency response: 10 Hz - 24 kHz / -0.1 dB @ 10 Hz ÷ 0.01 @ 24k THD + Noise: < 0.0006 % (-104 dB) @ 1 kHz -1dBFS

THD 3rd Harmonic: -126 dBFS @1 kHz, -10 dBFS

DAC (@ 44.1 kHz)

Frequency response: 20 Hz-21 kHz / - 0.4 dB @ 20 Hz ÷ 0.05 dB @ 21 kHz Noise: < -108 dB (unweighted)

THD+Noise: < 0.003% (-90 dB) @ 1 kHz, -1dBFS Maximum Output: +24 dBu

Output Impedance: 600 ohms @ 1 kHz

Crosstalk: < -102 dB (1 kHz, 0 dBFS)

Analog Output Stage

Maximum Output: +24 dBu
Output Impedance 600Ω

Latency (in Samples)

Digital-to-Digital
- 4 @ 44.1, 48K sampling rates
- 5 @ 88.2, 96K sampling rates

Analog-to-Analog
- 95 @ 44.1, 48K sampling rates
- 58 @ 88.2, 96K sampling rates

Front Panel
I/O selector: Analog, AES (XLR), S/PDIF (RCA/Optical) Sync: Internal, Digital, external word sync
Sample Rates: 44.1, 48, 88.2, 96 kHz

Control	Range
Input Gain	-20 to 0
Threshold	0 to 10 (0.1 steps)
Time Constant	1, 2, 3, 4, 5, 6
On/Off	On, Off
Mains	Off, 50 Hz, 60 Hz
Link	Left/Right, Linked, Lat/Ver
Output	-18 dB to 18 dB (0.1 steps)

Back Panel

Analog input: XLR/1/4" Jack Combo Input Lift/Ground: Toggle Switch

Analog output: Balanced XLR, unbalanced 1/4" 2-conductor phone plug Output Lift/Ground: Toggle Switch

Digital input/output: AES (XLR), S/PDIF (RCA), S/PDIF (Optical) SPDIF output selector: Toggle Switch

External word clock: BNC connector

Word Clock Termination: Toggle Switch – 75Ω (On) / 1M Ω (Off)

Main power supply: Linear Power Supply Adjustable Fuse: 100VAC, 110VAC, 220VAC, 240VAC. 50-60Hz

Dimensions

Box Width (behind the front panel): Metric - 440 mm, Imperial - 17 3/8" Height: Metric- 85 mm, Imperial- 3 3/8"

Depth: Metric- 220 mm, Imperial- 8 5/8" 2U 19" Standard Rackmount

PuigChild's front panel contains four 6mm diameter bolt fastening holes Weight: 4.0kg (8.8 pounds)

Troubleshooting & Frequently Asked Questions

There are little clicks and pops, like some type of static, when using the PuigChild.
This is nearly always a synchronization issue. Make sure that your Sync selection is proper. If you are using digital inputs, then you should select (D) for Digital sync, to lock to the selected digital input. This gives the lowest jitter performance and should solve any clock problems. If for some reason you have the Sync set to Internal while using a Digital input, it is nearly guaranteed that you'll have clicks and pops.

What is the advantage of 48-bit resolution when all of my audio ends up at 16-bit?
It's a great advantage even if you start with 16-bit audio (which most of the world will do for awhile). Just think of it as more accurate audio math, because it is! Using 48-bit math simply keeps track of more detail while the processing is going on. Multiply 2 decimal numbers together, and nearly always you get a number with a longer decimal; that is precisely what is happening with 48-bit audio and dithering to your final output. The resulting resolution is as good as you can get, preserving as much detail as pos-sible.

Contact Waves Sales and Technical Support

Before writing or calling Waves for technical support, please first check www.wavesupport.net for technical support issues and the latest information. Email tech support is preferred, and is more efficient for providing complete documentation to you. We hope you get the most from your new PuigChild. Please contact us should you experience any problems or want to know more about Waves.

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